Martin Creek Outlet Design/Build Report

Kosciusko County, Indiana

Prepared for:

Wawasee Area Conservancy Foundation
P.O. Box 548
Syracuse, Indiana 46567

Prepared by:

708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400

MARTIN CREEK OUTLET DESIGN/BUILD REPORT
EXECUTIVE SUMMARY

This project addresses the deteriorated riprap spillway located on Martin Creek's confluence with Lake Wawasee in Kosciusko County, Indiana. Heavy storm flows within Martin Creek had washed large amounts of the riprap spillway into the lake. A large plunge pool had also formed at the base of the structure. The primary goal of the project was to reengineer and construct the spillway in manner that would withstand future stormflows. This was accomplished through the installation of gabion baskets. In addition, a new sediment trap was incorporated into the design to capture sediment being delivered to Lake Wawasee from Martin Creek. This project was made possible in part by the cooperation of the Wawasee Area Conservancy Foundation and Karen Belcher (landowner). This project was also made possible with funding from the Indiana Department of Natural Resources' Lake and River Enhancement (LARE) Program.

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MARTIN CREEK OUTLET DESIGN/BUILD REPORT
KOSCIUSKO COUNTY, INDIANA

1.0 PROJECT DESCRIPTION AND PURPOSE

Martin Creek is a small, intermittent stream located on the southwest side of Lake Wawasee in Kosciusko County, Indiana. Martin Creek enters a 3.2-foot by 4.7-foot culvert located underneath South Road before draining over a riprap spillway into Lake Wawasee. Heavy storm flows had washed large amounts of the riprap spillway into Lake Wawasee. A large plunge pool had also formed at the base of the structure (Figure 1). The purpose of this project was to reengineer and construct the spillway in manner that would withstand future stormflow events while also incorporating a new sediment trap into the structure.

Figure 1. Riprap spillway before project construction.

2.0 DESIGN RATIONALE

Installation of a concrete spillway, sheetpile containment, or interlocking pavement blocks was considered for this project. None of these alternatives were deemed feasible primarily due to cost and poor aesthetic value. The high discharge rate of water exiting the culvert, coupled with a steep outlet gradient, dictated that the new design incorporate a means of holding the rock in place. The installation of gabion baskets would prevent the riprap from being washed downstream into the lake during strormflow events.

In addition to the gabion baskets, a sediment trap was constructed at the base of the new spillway to capture sediment being delivered to Lake Wawasee. Prior to the installation of the sediment trap, sediment was being washed into the lake from the scour hole at the base of the old structure and from Martin Creek itself.

3.0 DESIGN AND CONSTRUCTION SPECIFICS

3.1 Landowner Agreement

The project was constructed on a single landowner's property. A signed copy of the landowner agreement is held on file at JFNew's corporate office located in Walkerton, Indiana and the Wawasee Area Conservancy Foundation office.

3.2 Permitting

Notifications were submitted to the U.S. Army Corps of Engineers and Indiana Department of Environmental Management under the Regional General Permit guidelines. An Indiana Department of Natural Resources permit was not required for this project since the drainage area at the downstream end of the project site was less than one square mile. Permit correspondence can be found in Appendix A. No response was received from either agency.

3.3 Gabion Baskets

Riprap was recycled from the original spillway and stockpiled onsite by an excavator. A stable foundation on which to install the gabion baskets within the spillway was excavated. The gabion baskets were assembled onsite and placed into position before being filled with rock as per the Plan View and Gabion Details located in Appendix B. Gabion basket surfaces that would be visible after installation were partially filled with fieldstone (Figure 2). The remainder of the basket was filled with recycled riprap from the old spillway. The gabion baskets were closed and secured to one another with galvanized metal staples.

Figure 2. Completed gabion basket showing fieldstone face.

3.4 Sediment Trap

After all of the gabion baskets were installed, a sediment trap was excavated at the base of the spillway as per the Plan View in Appendix B. The sediment trap was excavated to a depth of approximately four feet at its center and three feet around its perimeter. It measured approximately 18 feet by 17 feet. The eastern and western slopes of the sediment trap were armored with riprap placed over a non-woven geotextile blanket (Figure 3). The northern and southern boundaries of the sediment trap were armored with gabion baskets. Additional riprap was placed along the bottom of the sediment trap, immediately below the spillway, to prevent scouring and plunge pool formation.

Figure 3. Sediment trap

3.5 Slope Stabilization

Installing a series of five soil encapsulated lifts stabilized the slope parallel to South Road. The first soil encapsulated lift bound each side of the culvert and matched the elevation at the top of the culvert. This provided a foundation on which to construct the remaining lifts. Each lift was constructed by encapsulating topsoil within two layers of erosion control blanket behind a removable form used to shape the lift. The inner layer of erosion control blanket was a biodegradable straw blanket (North American Green SC75). The outer layer was a heavy, woven coconut fabric (Dekowe). In addition, geogrid was incorporated into each soil encapsulated lift to prevent sheering of the slope. Soil was placed behind the forms, compacted, and then seeded along the exposed faces. A seeding list can be found in Appendix C. The erosion control blankets were then folded back over the soil and secured with oak stakes and six-inch metal sod staples. The forms were then pulled and placed on top of the preceding lift. This process was repeated until the elevation of the final soil encapsulated lift matched that of the roadside edge (Figure 3).

Figure 3. Soil encapsulated lifts.

A single soil encapsulated lift was installed on top of the 3x3 foot gabion baskets along each side of the spillway following the procedure outlined above. Topsoil was delivered to the project site and graded to match the existing landscape. Native plants were installed within a 15-foot buffer immediately adjacent to the soil encapsulated lifts along the spillway. A list of the native plant species used can be found in Appendix C. The remainder of the lawn area disturbed during construction was reseeded with a fall planting seed mix and then covered with straw (Figure 3).

4.0 CONSTRUCTION SCHEDULE

Construction began on October 25, 2004 with the stockpiling of riprap and placement of gabion baskets adjacent to South Road. Gabion basket installation and sediment trap excavation was completed by October 4, 2004. Soil encapsulated lift construction, regrading, planting, and site cleanup was completed by November 9, 2004. No construction activity occurred on October 27-28, 2004.

5.0 MONITORING AND MAINTENANCE ACTIVITY

The project site should be monitored on an annual basis for the next three to five years. Monitoring should include the inspection of the gabion baskets, soil encapsulated lifts, and plantings. Monitoring of the sediment trap should be conducted every two to three years over the life of the project site to determine maintenance cleaning needs. This can be determined by measuring the depth of the sediment trap based on the elevations described in the "as-built" construction drawings. During the annual inspection, the observer should ascertain the structural integrity of the gabion baskets. Some of the potential failures to look for include voids created behind or under the baskets created by running water, drastic sags in the baskets created by voids or settling, and structural failure of the baskets themselves (i.e. breaks in the wire, loss of staples, etc.). Additionally, soil encapsulated lifts should be inspected for washouts or tears in the erosion control blankets used in their construction. Other monitoring activities should include the inspection of plantings along the soil encapsulated lifts and slopes. If large barren patches, approximately one square yard, are noted along the soil encapsulated lift, they should be

reseeded with an appropriate seed mix. If any of these situations are noted during the inspection, action should be taken to resolve the situation in a timely manner.

6.0 PROJECT SUMMARY

Heavy storm flows within Martin Creek had washed large amounts of the previous riprap spillway into Lake Wawasee and formed a large plunge pool at the base of the structure. The purpose of this project was to reengineer and construct the spillway in manner that would withstand future stormflow events. This was accomplished by armoring the spillway and with gabion baskets. A new sediment trap was also incorporated into the structure to prevent sediment from being delivered to Lake Wawasee from Martin Creek. In addition, the area adjacent to the new spillway was replanted with native species to help stabilize the slopes and provide a more aesthetically pleasing structure.

APPENDIX A
PERMIT CORRESPONDENCE

Indiana Department of Environmental Management
Office of Water Quality
Section 401 Water Quality Certification Program

Regional General Permit - IDEM Notification Form (Revised January 1, 2002)

FOR IDEM USE ONLY	Date Rec'd	IDEM ID:

1. Applicant Information

Applicant: Wawasee Area Conservancy Foundation	Agent: J.F. New and Associates, Inc.
Contact person: Heather Harwood	Contact person: John Richardson
Address: P.O. Box 548 Syracuse, IN 46567	Address:708 Roosevelt Road Walkerton, IN 46574
Phone: 574-457-4549	Phone: 574-586-3400

2. Project Location

County: Kosciusko		Nearest Town: Syracuse	
Quad: Lake Wawasee, IND	Township: 34N	Range: 7E	Section: 23
Latitude: 41 23 02 N UTM 4582202 N	Road Directions: State Road 13 south of Syracuse to 1060 North Road (across from Southshore Golf Club) 1/2 mile east to 800 East, then 1/4 mile south to South Road (Leeland Addition). East on South Road to culvert crossing at first open water channel (north side)		
Longitude: 85 41 28 E UTM 609440 E			

3. Existing Conditions

Wetlands: NO	Acreage onsite: none
Wetland type: N/A	
Stream: YES	Stream name: Martin Creek
Open water: YES	Open water type: Lake Channel

4. Project Impacts

Activity description: The existing riprap at the culvert outfall of Martin Creek into the LeeLand channel will be placed into gabion mats and gabion baskets. The majority of existing riprap will be excavated to a level foundation for the gabion structure and then the gabions will be filled with the same riprap (approximately 80 cubic yards) and approximately 40 cubic yards of additional fieldstone to improve appearance of gabions. Gabions will be topped with earthen fill above the high water line and planted with vegetation. A sediment trap will be created between the existing open water lake channel and the end of the gabion structure so that sediments from the creek can be captured prior to entering the lake. A gabion spillway will be constructed in the same manner above to isolate the sediment trap from the lake channel. There will be a net decrease in exposed rock lining the channel and a net increase in flow area of the channel.

Purpose of project: To stop existing riprap at the Martin Creek outfall into Lake Wawasee from being washed into lake during major storm events and to trap sediments from Martin Creek.	
Acres of wetland impact - None (the entire project site is existing riprap)	
Linear feet of stream impact: 45	Acres of open water impact: none
Area of riprap below the OHWM: Existing area affected by riprap: 0.02 ac. (450 sq. ft) Proposed area after project completion: 0.01 ac (300 sq ft)	

Indiana Department of Environmental Management
Office of Water Quality
Section 401 Water Quality Certification Program

Signature of Applicant - Statement of Affirmation

I certify that I am familiar with the information contained in this notification and, to the best of my knowledge and belief, such information is true and accurate. I certify that I have the authority to undertake and will undertake the activities as described in this notification. I am aware that there are penalties for submitting false information. I understand that any changes in project design subsequent to IDEM's granting of authorization to discharge to a water of the state are not authorized and I may be subject to civil and criminal penalties for proceeding without proper authorization. I agree to allow representatives of the IDEM to enter and inspect the project site. I understand that the granting of other permits by local, state, or federal agencies does not release me from the requirement of obtaining the authorization requested herein before commencing the project.

Applicant's Signature: Heather Harwood Date: Oct. 5, 2004

Print Name: Heather Harwood Title: Coordinator

APPENDIX B
SITE PLAN AND DESIGN DETAILS

WAWASEE AREA CONSERVANCY FOUNDATION

KOSCIUSKO COUNTY
SYRACUSE, INDIANA

LEE LAND ADDITION
OCTOBER 2004

As- Built

JFNew
http://www.jfnew.com

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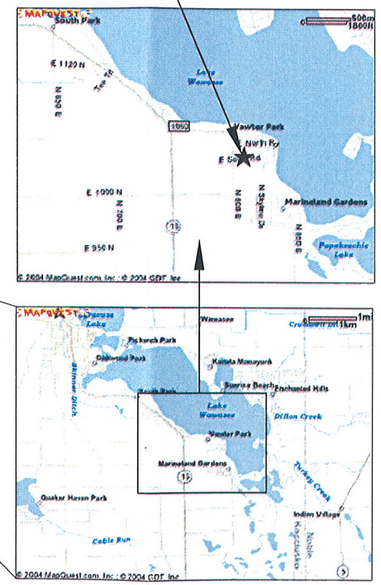
INDEX OF DRAWINGS

APPROXIMATE PROJECT LOCATION



VICINITY MAP

N

PRELIMINARY ENGINEERING DRAWING:
NOT APPROVED FOR CONSTRUCTION.

JFNEW QUALITY ASSURANCE QUALITY CONTROL			
CHECK [X] 50% REVIEW		CHECK [X] 90% REVIEW	
ECOLOGICAL REVIEWER	JJR	ECOLOGICAL REVIEWER	JJR
REST. MGMT. REVIEWER	SCR	REST. MGMT. REVIEWER	BM
ENGINEERING REVIEWER	ALB	ENGINEERING REVIEWER	DJL

INITIALS

REVISIONS:

SCALE VERIFICATION
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Our mission is to provide the highest quality environmental services to our clients while positively impacting the lives of our employees and the conservation of natural resources through prosperity and stewardship.

JFNew

WAWASEE AREA CONSERVANCY FOUNDATION
LEE LAND ADDITION
MARTIN CREEK OUTLET
COVER SHEET - VICINITY MAP

DRAWN BY:	JFH
DESIGNED BY:	JJR
CHECKED BY:	DJL
DATE:	OCT 2004
JOB NO:	030737
SCALE:	AS NOTED

ANDREW L. BENDER
REGISTERED
No. 10100192
STATE OF INDIANA
PROFESSIONAL ENGINEER

01-COVER.DWG

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OF 6

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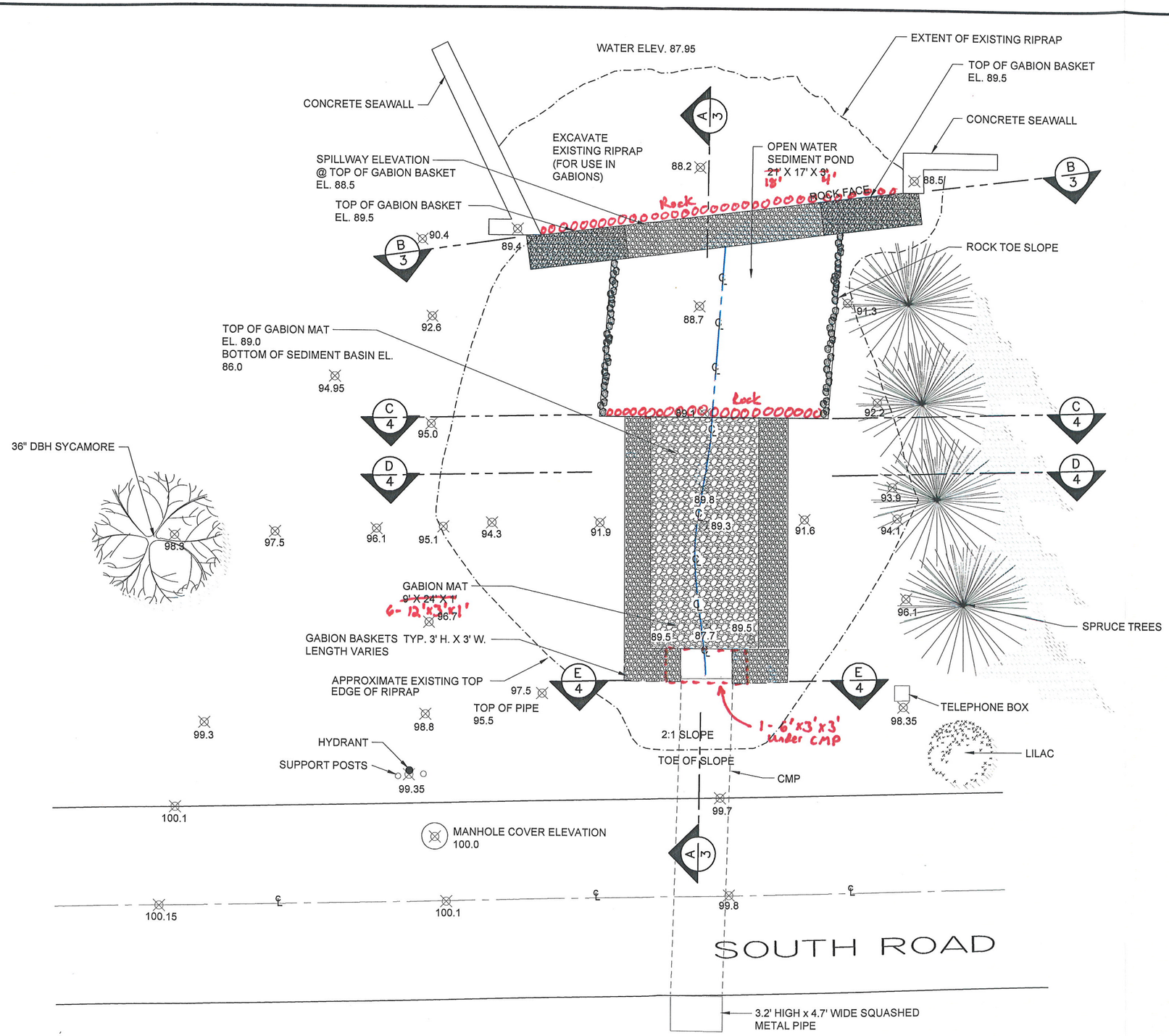

REVISIONS:

LEGEND

- GABION BASKET
- GABION MAT
- EXISTING RELATIVE SPOT ELEVATION

N

0 5'

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WAWASEE AREA CONSERVANCY FOUNDATION
LEE LAND ADDITION
MARTIN CREEK OUTLET
PLAN VIEW

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02-SITEPLAN.DWG

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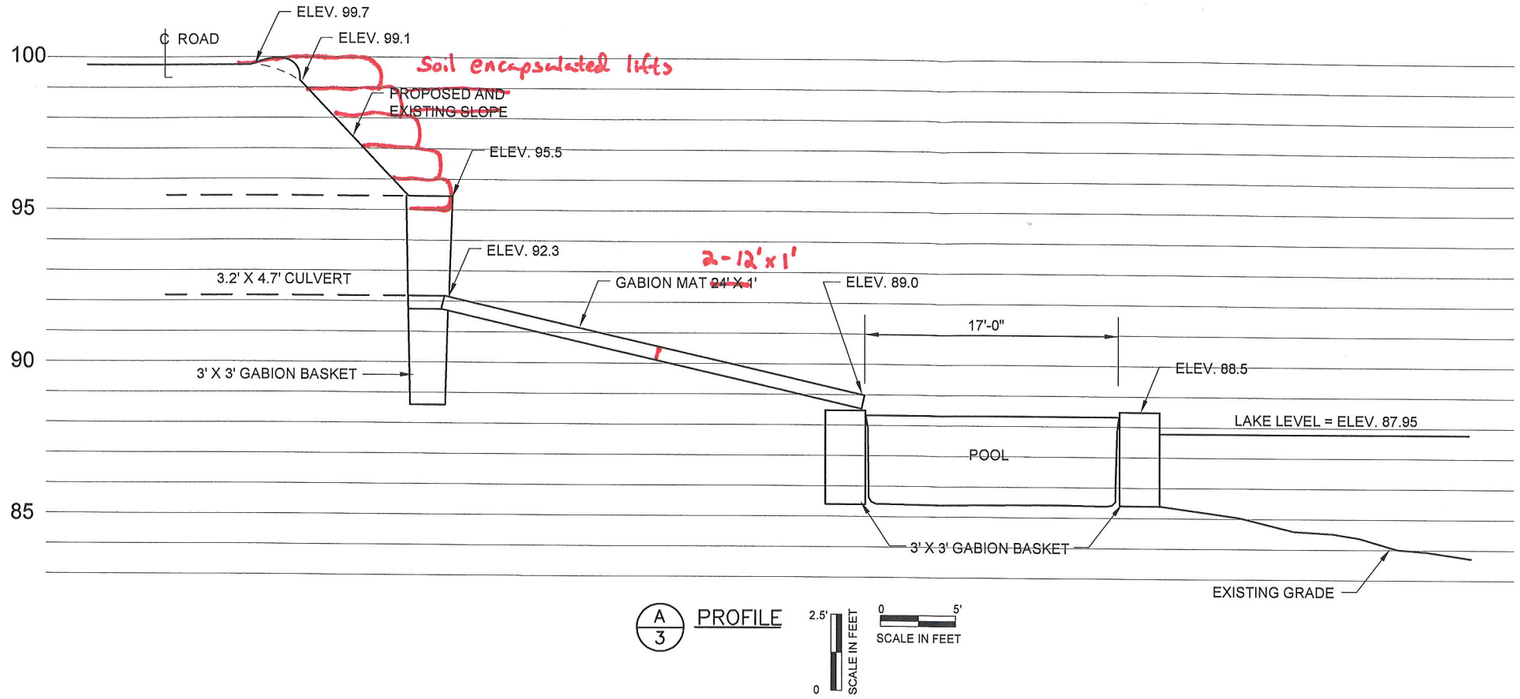

A/3 PROFILE

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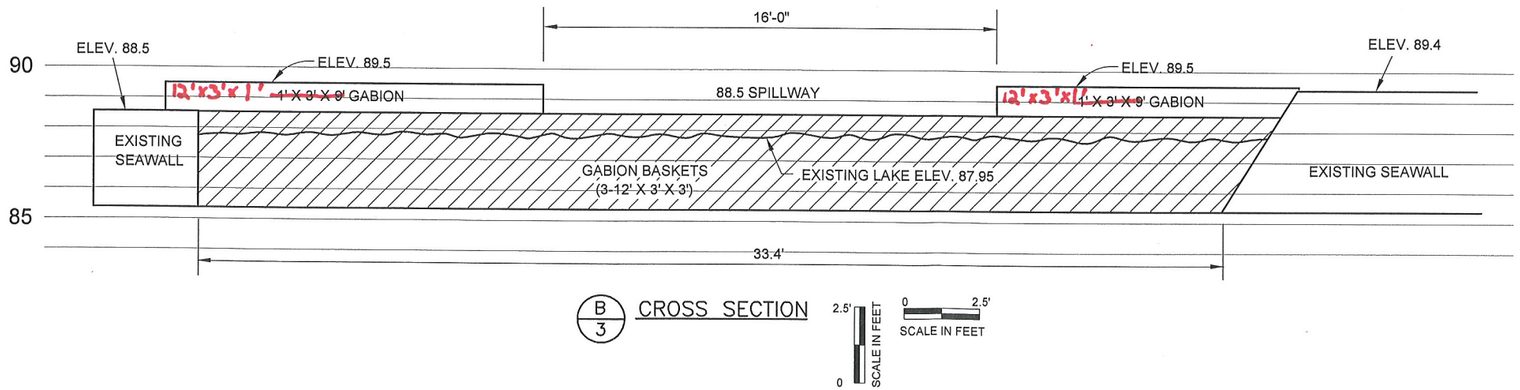

B/3 CROSS SECTION

2.5' 0 SCALE IN FEET

0 2.5' SCALE IN FEET

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WAWASEE AREA CONSERVANCY FOUNDATION
LEE LAND ADDITION

MARTIN CREEK OUTLET

PROFILE AND SECTION

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03-PROFILE.DWG

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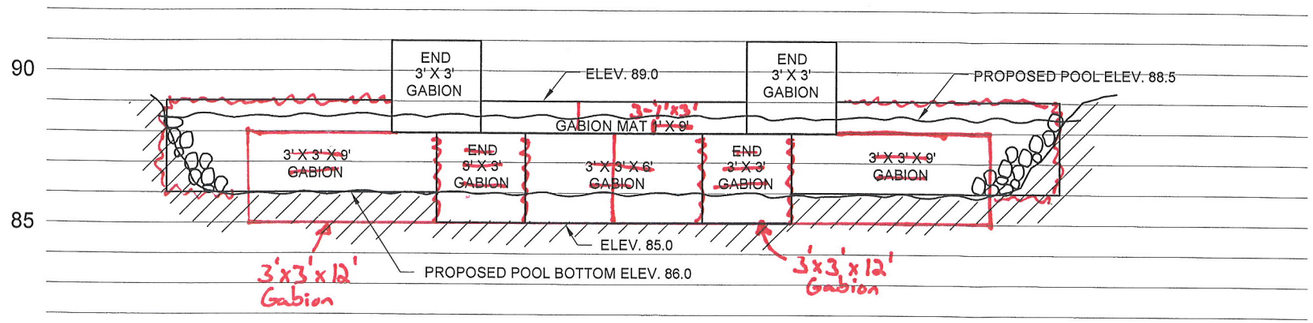

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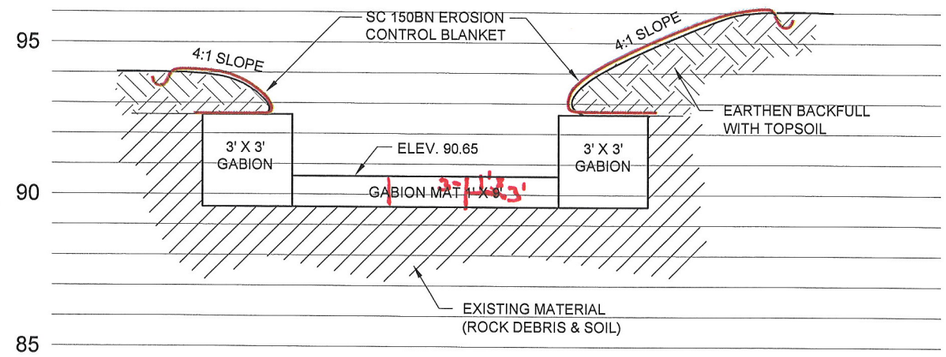

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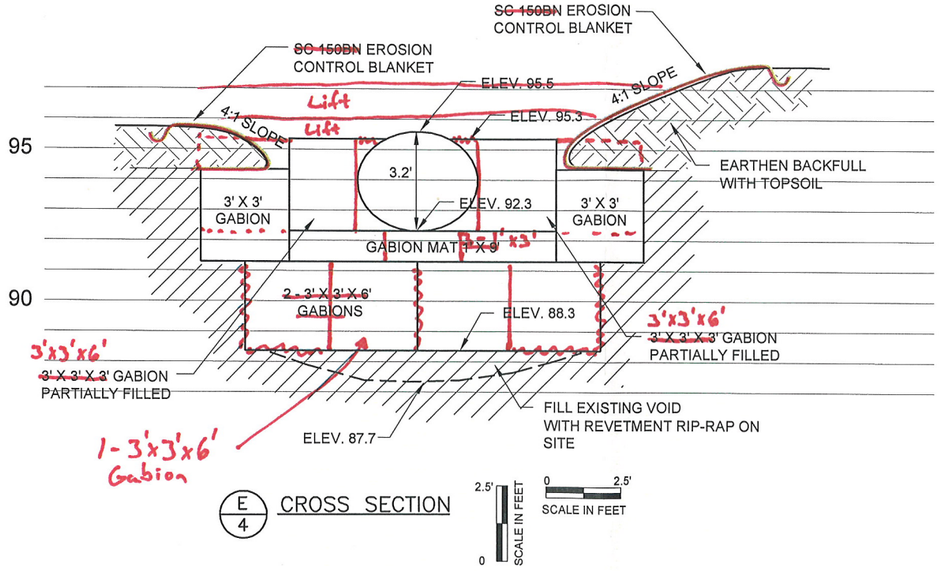

E/4 CROSS SECTION

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WAWASEE AREA
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LEE LAND ADDITION
MARTIN CREEK OUTLET
SECTIONS

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04-SECTIONS.DWG

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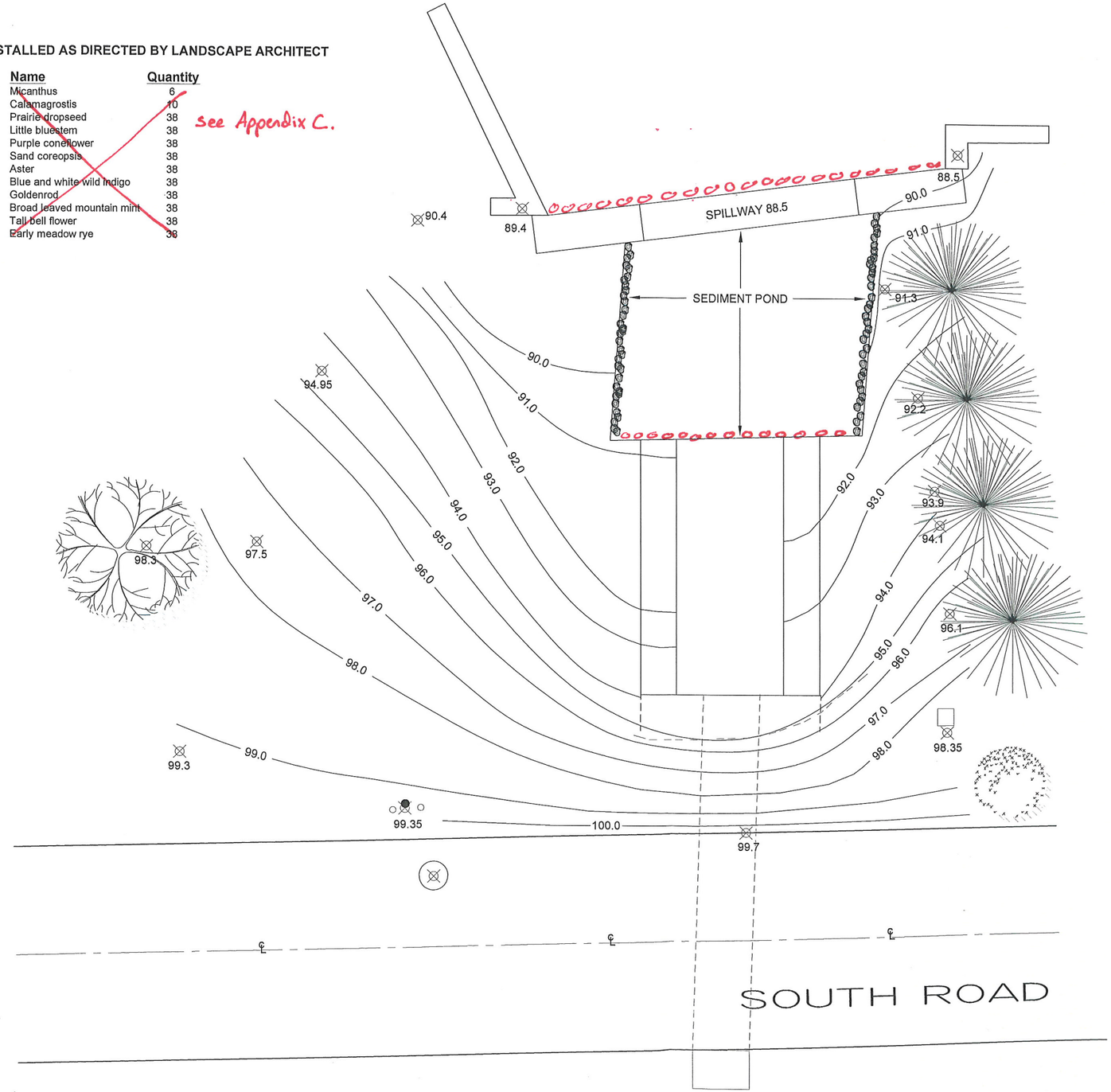
PLUGS TO BE INSTALLED AS DIRECTED BY LANDSCAPE ARCHITECT

Name	Quantity
Micanthus	6
Calamagrostis	10
Prairie dropseed	38
Little bluestem	38
Purple coneflower	38
Sand coreopsis	38
Aster	38
Blue and white wild indigo	38
Goldenrod	38
Broad leaved mountain mint	38
Tall bell flower	38
Early meadow rye	38

see Appendix C.



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WAWASEE AREA CONSERVANCY FOUNDATION
LEE LAND ADDITION
MARTIN CREEK OUTLET
FINAL GRADE

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PROFESSIONAL ENGINEER

05-PLANTING PLAN.DWG

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5

OF 6

Stephen - C:\Projects\2004-10-3305-PLANTING.dwg - Thu, 18 Nov 2004 - 10:00

REVISIONS:

MACCAFERRI

TECHNICAL DATA SHEET
Rev: 00, Issue Data 30.04.2004

GABIONS
POLYMAC

Gabions are baskets made of double twisted steel woven wire mesh, as per EN 10223-3 (Figs. 1, 2). Gabions are filled with stones at the project site to form flexible, permeable, monolithic structures such as retaining walls, channel linings, and weirs for erosion control projects.
The steel wire used in the manufacture of the gabion is heavily galvanized with Galfan, a Zn-5%Al-MM (mischmetal) alloy. A polymer (self extinguish modified polyethylene) coating is then applied to provide added protection for use in polluted environments where soils or water are acidic: in salt or fresh water, or wherever the risk of corrosion is present. The polymer coating has a nominal thickness of 0.50 mm. The standard specifications of mesh-wire are shown in Table 2.
The gabion is divided into cells by means of diaphragms positioned at approximately 1m centers (Fig.1). In order to reinforce the structure, all mesh panel edges are selvedged with a wire having a greater diameter (Table 3).
Dimensions and sizes of Galfan + Polymer coated gabions are shown in Table 1.

Wire

All tests on wire must be performed prior to manufacturing the mesh.

1. **Tensile strength:** the wire used for the manufacture of gabions shall have a tensile strength between 350-500N/mm² according to EN 10223-3. Wire tolerances (Table 3) are in accordance with EN 10218 (Class T1).
2. **Elongation:** Elongation shall not be less than 10%, in accordance with EN 10223-3. Test must be carried out on a sample at least 25 cm long.
3. **Galfan coating:** minimum quantities of Galfan shown at Table 3 meet the requirements of EN 10244-2 (Table 2 and Class A).
4. **Adhesion of Galfan:** the adhesion of the Galfan coating to the wire shall be such that, when the wire is wrapped six turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers.

X.P.E. coating

In addition to the galvanisation, the steel wire is coated with a self extinguish modified polyethylene (XPE) sheet, according to EN-10245-3 with a nominal thickness of 0,50 mm.

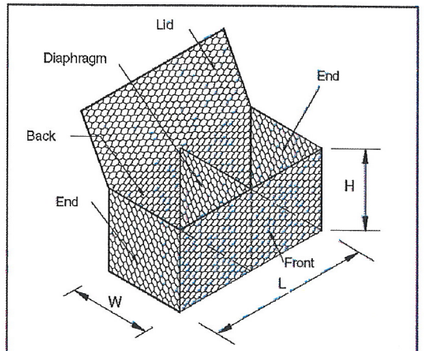
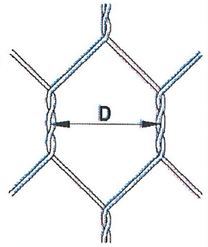


Figure 1



The tolerance on the opening of mesh 'D' being the distance between the axis of two consecutive twists, is according to EN 10223-3
Figure 2

The technical characteristics of the polymer coating are in the following table.

Technical characteristics			
TENSILE STRENGTH			
- yield strength	ASTM D638	Mpa	18
- elongation at Yeld		%	40
- strength at break		Mpa	18
- elongation at break		%	480
- elongation at break		Mpa	780
STRENGTH AT TEMPERATURE			
- Hot Set Test (H.S.T.)*	EIC 540	%	<100%
- Residual elongation	EIC 540	%	<15%
FIRE RESISTANCE	ASTM D479		
- flame application time		sec.	30
- self extinguish time		sec.	35
- dripping during flame exposure			NO
- burned length		mm	30

MACCAFERRI

Maccaferri reserves the right to amend product specifications without notice and specifiers are requested to check as to the validity of the specifications they are using.

1. Table of sizes for gabions

L=Length (m)	W=Width (m)	H=Height (m)	# of cells
2	1	0.5	2
3	1	0.5	3
4	1	0.5	4
1.5	1	1	1
2	1	1	2
3	1	1	3
4	1	1	4

All sizes and dimensions are nominal.
(Table 1) Tolerances of ± 5% of the width, height, and length of the gabions shall be permitted.

2. Standard Mesh-Wire

Type	D (mm)	Tolerance	Internal Wire Dia (mm)	External Wire Dia (mm)
8x10	80	+16%/-4%	2.70	3.70

3. Standard wire diameters

		Mesh Wire	Selvedge Wire	Lacing Wire
Polymac Mesh Diameter	ø mm	Int.2.7/Ext.3.7	Int.3.4/Ext.4.4	Int.2.2/Ext.3.2
Wire Tolerance	(±) ø mm	0.06	0.07	0.06
Min. Q.ty of Galfan	gr/m²	245	265	230

Lacing Operations

Lacing operations can be made by using the tools shown in Fig.5. Galfan coated steel rings having the following specification can be used instead of lacing wire (Figs. 3, 4):
- diameter: 3.00 mm
- tensile strength: 170 kg/mm²

Spacing of the rings must not exceed 200 mm (Fig.3)

Quantity Request

When requesting a quote, please specify:
- size of units (length x width x height, see Fig.1),
- type of mesh,
- type of coating

EXAMPLE: No. 100 gabions 2x1x1m - Mesh type 8x10 - Wire diam. 2.7/3.7 mm - Polymac coated

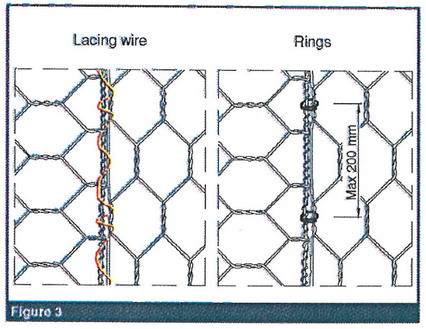


Figure 3

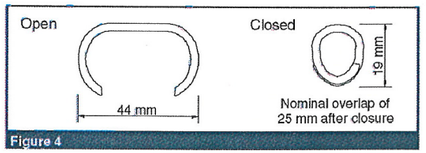


Figure 4

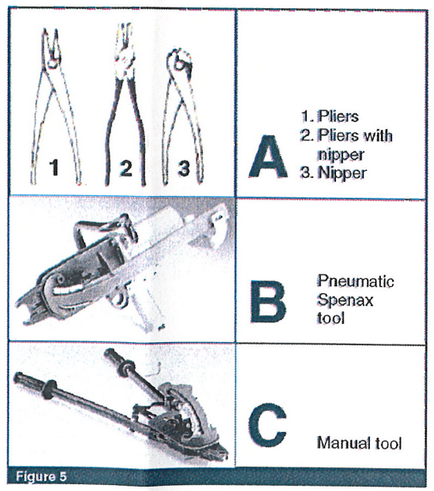


Figure 5

Officine Maccaferri S.p.A.
Via Agresti, 6 - P.O. BOX 396 - 40123 Bologna (Italy)
Tel. (+39) 051-6436000 - Fax (+39) 051-236507
E-mail: comes.officine@maccaferri.com - Web site: www.maccaferri.com

PRELIMINARY ENGINEERING DRAWING:
NOT APPROVED FOR CONSTRUCTION.

Corporate Office
705 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400 fax 574-586-3446

Cincinnati Office
8050 Beckett Center Dr., Suite 226
West Chester, Ohio 45069
513-942-3446 fax 513-942-3447

Illinois Office
722 West Exchange, Suite 4
Crete, Illinois 60417
708-367-1130 fax 708-367-1132

Indianapolis Office
6040 Parkdale Place, Suite B
Indianapolis, Indiana 46254
317-388-1982 fax 317-388-1986

Michigan Office
600 South Beacon
Grand Haven, Michigan 49417
616-847-1680 fax 616-847-0970

JFNew

WAWASEE AREA CONSERVANCY FOUNDATION
LEE LAND ADDITION
MARTIN CREEK OUTLET
GABION DETAILS

DRAWN BY:	JL/JFH
DESIGNED BY:	JL
CHECKED BY:	DJL
DATE:	OCT 2004
JOB NO:	030737
SCALE:	AS NOTED

ANDREW L. BENDER REGISTERED No 10100192 STATE OF INDIANA PROFESSIONAL ENGINEER

06-DETAILS.DWG

DRAWING NO.
6
OF 6

Stephen - C:\Projects\2004-10-3106-DETAILS.dwg - Thu, 18 Nov 2004 - 10:00

APPENDIX C
PLANT LIST

J. F. New Native Plant Nursery

128 Sunset Drive, Walkerton, IN 46574 · Phone: (574) 586-2412 · Fax: (574) 586-2718

Packing Slip

Order Number	*Order Date*	*Salesperson*	*Shipping Method*	*Ship Date*	*Terms*
EN-2004-0008	10/12/04	Mark O'Brien	Customer Pickup	10/15/04	Net 30 Days

Client Information

Name: JFNew -- Environmental Divison
Contact: John Richardson
Project Number:
Project Name: Plugs and seed
P.O. Number:

SHIP TO: 708 Roosevelt Rd.
Walkerton, IN
46574- USA

PHONE: (219) 586-3400

Stock Number	*Scientific Name*	*Common Name*	*Quantity Ordered*	*Units*	*Quantity Shipped*	*Initials*	*Comments*
PG-ANDSCO-P38	Andropogon scoparius	LITTLE BLUESTEM GRASS	76	each	76		
PG-ANDSCO-SP	Andropogon scoparius	Little bluestem grass	16	oz.	30.77		
WF-ASTNOV-P38	Aster novae-angliae	NEW ENGLAND ASTER	38	each	38		
PF-BAPAUS-P38	BAPTISIA AUSTRALIS	BLUE WILD INDIGO	38	each	38		
PF-CAMAME-P38	Campanula americana	TALL BELLFLOWER	38	each	38		
PG-CXPENS-P38	Carex pensylvanica	COMMON OAK SEDGE	76	each	76		
PF-CORLAN-P38	Coreopsis lanceolata	SAND COREOPSIS	38	each	38		
PF-ECHPUR-P38	Echinacea purpurea	BROAD-LEAVED PURPLE CONEFLOWER	38	each	38		
WG-ELYVIR-SP	Elymus virginicus	Virginia wild rye	80	oz.	80		
CC-LOLMUL-SP	Lolium multiflorum	Annual rye	160	oz.	160		
WF-PYCMUT-P38	Pycnanthemum muticum	BROAD-LEAVED MOUNTAIN MINT	38	each	38		
PF-SOLRIG-P38	Solidago rigida	STIFF GOLDENROD	38	each	38		
PG-SPOHET-P38	Sporobolus heterolepis	PRAIRIE DROPSEED	76	each	76		
PF-THADIO-P38	Thalictrum dioicum	EARLY MEADOW RUE	38	each	38		

Notes: If you need subs, use something colorful.

Seed Packed By: _____ ***Date:*** _____ ***Shipped By:*** _____

Plants Packed By: _____ ***Date:*** _____ ***Received By:*** _____

Trees Packed By: _____ ***Date:*** _____ ***Date:*** _____

To receive credit or refund, please report and return unacceptable product within 3 days of receipt.